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COMPOSITAE NEWSLETTER

Number Four March 1977

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EDITORIAL

It is a great pleasure to announce that Mr. Sven Koeltz of Otto Koeltz Antiquariat has agreed to cover all duplicating and mailing costs of the COMPOSITAE NEWSLETTER beginning with this issue. This is a welcome financial contribution as it obviates the solicitation of funds from readers in the near future. My own business dealings with Otto Koeltz Antiquariat over the past years have been excellent, and I encourage the readers of the NEWSLETTER to take advantage of their new, used, and reprint botanical offerings. The Department of Botany of The Ohio State University is still providing secretarial assistance for preparing the typescript, and this continuing contribution also is very much appreciated.

Discussion has occurred recently in several laboratories here in the United States on the precise meaning of morphological terms commonly used in systematic studies of Compositae, such as palea, throat, limb, squamella, etc. John Strother (Univ. California, Berkeley) and Harold Robinson (Smithsonian Institution, Washington, D.C.) have agreed to prepare a Glossary of Terms Used in Synantherology provided other workers believe such a project would be useful. My personal view is that this would be very helpful. For convenience in responding to their ideas, the last page of the NEWSLETTER is a tear-off form that may be used to reply. I hope you will take the opportunity to share your opinions with them.

ARTICLES

PHILOSOPHY OF SMALL CONTACT DERMATITIS FROM LICHENS, LIVERWORTS, COMPOSITAE SPECIES AND SESQUITERPENE LACTONES

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During the past ten years we have enjoyed an inter-disciplinary and social intercourse which has given much pleasure and interesting work to various botanists, phytochemists and dermatologists. As a result of work supplemented by home dinner discussions, we have published a lot -- some 64 papers in the past three years. I have been asked to write a report for the NEWSLETTER and will take an historical approach. An historical approach may not become apparent from published work where it is often necessary to reverse the order of the thinking-- nor from grant applications where it is sometimes necessary to apply to do work for which one already knows the answer in order to break new ground.

Historically, I phoned up a curious character in Botany to say that I had a patient who was skin contact allergic to lichens. I asked him, naively I suppose, to redirect his research effort to this obviously important field. He replied, somewhat obscurely I thought, that money was required for such work. So we eventually got some. This curious character turned out to be Neil Towers (I use the word curious in the Joseph Banks and 18th Century sense of a man interested in the natural arts and sciences, then hardly rigidly distinguished). He suggested that d-usnic acid might be an allergen of lichens, not L-usnic acid. So it turned out to be, a fascinating example of stereoisomeric immunological specificity in allergic contact dermatitis (Mitchell, 1966). It also turned out that the French knew about allergy to lichens before we did (Dr. LeCoulant, Dr. Foussereau, Professor Ourisson and their co-workers), but not, it seems, about d- and L-usnic acid.

We turned to "cedar-poisoning", a mysterious skin disease of British Columbia forest workers who had dermatitis from exposure to vegetation. The disorder was not then accepted as a compensable entity by the Workers' Compensation Board. It was economically crippling to many workers who were disabled by recurrent dermatitis at work. The blame for the dermatitis was unjustly laid to yellow cedar (Thuja). We found, during five years, 75 such workers who were contact allergic to a liverwort, Frullania, which grows on cedar and other trees. Liverworts and lichens were the cause of so-called "cedar-poisoning". The French workers beat us to it here too - they knew about the allergy to Frullania and identified an allergenic sesquiterpene lactone (Knoche et al 1969).

But one of our forest workers who was contact allergic to Frullania retired from forest work and took up the hobby of growing chrysanthemums. He found that he was contact allergic to Chrysanthemum. With the aid of his sons, we dug up and discarded all his Chrysanthemum cultivars, but he did not get better - his severe dermatitis continued unabated. I visited his home (we still do house calls here) and found that as he sadly contemplated his empty Chrysanthemum beds, he was pulling up a weed which was rampart in the beds, namely tansy (Tanacetum vulgare). What had that to do with it? A weedy tansy hardly looks to an uneducated eye like a Chrysanthemum in full flower in our garden shows. I phoned up my curious colleague who told me that Tanacetum was botanically and phytochemically related to Chrysanthemum and both yielded sesquiterpene lactones. This patient was then found to be contact allergic to lactones of many Compositae species. He recovered from dermatitis which had persisted for 50 years following some simple advice on gardening habits and avoidance of related plant allergens. It is said that an inter-disciplinary approach to medical problems is often surprisingly rewarding. This was certainly the case for this patient who had a severe and prolonged skin disease.

Then I learned that whatever phytochemists told me during our weekly dinner meetings could be written down the next day and published. This was not far from the truth; many phytochemical and botanical ideas found instant favourable reception from our dermatological journals. After all, Botany and Medicine have a very long association, only recently separated. The jargon of nomenclature is a problem--when are we to have a Linnaeus for biochemical nomenclature? At the present time naming of compounds is almost more incomprehensible than the naming of skin diseases. Can you beat Pityriasis lichenoides varioliformis (Mucha-Haberman)? What beast of the field is a synantherologist?

It is still amazing that workers in different parts of the world can independently but concomitantly think up a significant new idea or arrive at relevant synthesis of older ideas.

For example, we now know that patients who have dermatitis from the liverwort (Frullania) are also contact allergic to Costus and Champaca oils of perfumery (Saussurea, Compositae; Michelia, Magnoliaceae), to commercial white wood (Liriodendron, Magnoliaceae), to ragweed (Ambrosia, Compositae), to Chrysanthemum, Artemisia (Bitterweed), chichory (Cichorium), lettuce (Lactuca) and to numerous composite plants to which they may never have been exposed, such as Parthenium hysterophorus. The cross-sensitivity results from a common content of sesquiterpene lactones in the plants.

Parthenium hysterophorus is currently causing an explosive outbreak of "weed" dermatitis in India. Thousands of patients have developed severe contact dermatitis from contact with this plant recently introduced into India (Lonkar *et al*. 1974). The allergen is a sesquiterpene lactone. Interest in this epidemic has led to the formation of a Parthenium Research Group (see paper of Rodriguez *et al*. in this issue).

Some patients who have Compositae weed dermatitis appear to be reactive to light, that is, photosensitive . Thiophenes derived from Compositae are phototoxic in microbial systems. We do not yet know the role of thiophenes in Parthenium dermatitis. (Camm *et al*. 1975).

Quite likely, further cooperative work may produce useful results for patients who have disabling skin diseases. Thank you for the opportunity to contribute to the Compositae Newsletter.

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ALLERGIC CONTACT DERMATITIS AND SESQUITERPENE LACTONES

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Synantherologists suffering from sleepless nights brought on by constant itching and redness of the skin may find that their present dilemma is caused by a certain class of chemical constituents present in their favourite family - the Compositae. Our recent clinical experience at the University of British Columbia has established that a plethora of sesquiterpene lactones (isoprenoid derivatives present in taxa of all tribes of the Compositae with the exception of the Tageteae) are the major haptens involved in the formation of skin antigens (protein-hapten complex) that elicit delayed hypersensitivity reactions in man.

In this brief account we summarize the distribution of some sesquiterpene lactones known to cause allergic dermatitis, elaborate on the proposed mechanism of action of lactones and conclude with some comments on the objective(s) of an international group composed of dermatologists, phytochemists, taxonomists and immunochemists that are trying to find solutions to the control of aggressive weeds that cause dermatitis and treatment of people suffering from contact allergy.

Allergic contact dermatitis (poison-ivy or weed dermatitis)

Most people are familiar with allergies brought about by proteins (allergens) present in the pollen of Compositae species (e.g., hayfever from *Ambrosia* spp.). Dermatitis resulting from exposure to small molecular weight constituents of higher plants is more widespread than previously imagined. There are two major forms of contact dermatitis recognized. Irritant contact dermatitis resulting from exposure of the skin to plants such as Euphorbia spp. and species of Ranunculus spp. affects all individuals if the amount and duration of the exposure is sufficient. Allergic contact dermatitis results from exposure of the skin to constituents of Toxicondendron (poison-ivy), Primula obconica and members of the Compositae, and only affects some individuals who acquire a specific altered capacity to react to the plants. Such a capacity is not present at birth, but is acquired by postnatal exposure. Specificity for the micromolecular compounds (e.g., pentadecylcatechol in poison-ivy and sesquiterpene lactones in Compositae) designated as haptens (allergens), depends upon an altered immunological status of the individual and is mediated by sensitized T-lymphocytes rather than by antibody. This cell-mediated hypersensitivity is presented clinically by redness, vesiculation (small blisters within the dermis) and itching (1).

Pathogenetic mechanism of allergic contact dermatitis

Following initial contact with a plant that contains a chemical compound which is capable of producing cell-mediated hypersensitivity, a process of sensitization occurs in some individuals and, during the course of a minimum of six days, T-lymphocytes located in lymph glands become sensitized and are released into the blood stream. Following subsequent exposure to the specific sensitizer, circulating lymphocytes accumulate at the site where the antigen (allergen) is sequestered and destroy the cells. Dermatitis becomes manifested one to two days later at the skin site of re-exposure. Such a delay in the appearance of dermatitis at the site of re-exposure is indicated by an alternative term for the reaction, namely "delayed hypersensitivity." The pathogenetic mechanisms of allergic contact dermatitis are summarized in Figure 1.

Detection of delayed hypersensitivity

Delayed hypersensitivity may be detected by means of a "patch test." A chemical compound or acetone leaf extract is applied to the skin, by necessity in a non-irritiant dose, and the skin site is examined 48 hours later; a positive patch test reaction, provided nonspecific irritancy is excluded, indicates a state of delayed hypersensitivity. This is a deliberate elicitation, under controlled conditions, of allergic contact dermatitis and part of the clinical investigation of affected patients.

Distribution of sesquiterpene lactones known to cause dermatitis

Sesquiterpene lactones from species of the Compositae, Lauraceae, Magnoliaceae and from the liverwort, Frullania (Jubulaceae) have been shown to be a major class of allergens causing allergic contact dermatitis in humans (2-4). Over eighty lactones were used in patch tests to determine their allergenic potential, and the presence of α-methylene group exocyclic to the γ-lactone, was shown to be the principal immunochemical requisite for the production of dermatitis. One of the allergenic lactones was the pseudoguaianolide, parthenin, the major allergen present in the leaf trichomes of Parthenium hysterophorus L. (5). This extraordinarily aggressive weed was accidently introduced into India and other parts of the subtropical world from the Americas, and in certain cities of India, e.g., Poona, allergic contact dermatitis from P. hysterophorus has become an important dermatological and public health problem (6-7), affecting thousands of patients. A preponderance of males, in contrast to females and children, was affected by contact with the weed. Differences in the penetration of compounds through the skin may be an explanation for this. Among other plants (Table 1) responsible for dermatitis are tiny epiphytic liverworts of the genus Frullania, which causes dermatitis in forest workers who handle the bark of trees (3,8). The sesquiterpene lactone, frullanolide, identified in these epiphytic plants has been shown to be a potent sensitizer. Similar lactones have been found in species of the liverwort Diplophyllum (9). Many varieties of Chrysanthemum (10-12), Costus Absolute, a perfume material derived from Saussurea lappa (13) and laurel oil, from Laurus nobilis (3) are sources of dermatitis and sesquiterpene lactones have been implicated in each instance (Table 2 presents structures). Certain persons may thus cross-react by skin contact allergy to such diverse plants and plant products as ragweed (Ambrosia), liverwort (Frullania), horticulatural plants (Chrysanthemum), perfumes (Saussurea), weeds (Parthenium etc.), and vegetables (Cichorium etc.) from a common denominator, viz., a content of sesquiterpene lactones in the plants and plant products.

Mechanism of action of sesquiterpene lactones

Chemical allergens react with skin proteins to initiate the process of sensitization. Studies on the reactivity of sesquiterpene lactones with some amino acids with nucleophilic side-chains showed that lactones with an exocyclic methylene attached to a lactone were all capable of forming adducts by Michael-type addition (14-15). Alantolactone, the major lactone of Inula helenium, is capable of undergoing such addition with the sylphydryl group of cysteine, with the imidazole group of histidine and with the Σ-amino group of lysine, but not with the guanido group of arginine, the hydroxyl of serine or the thio-ether function of methionine (15). It therefore seems that all known allergenic lactones contain an exocyclic α-methylene function which probably conjugates with sulphydryl groups of skin proteins in cells by a Michael-type addition to form complete antigens capable of producing cell-mediated contact allergic reactions (1).

International study group for dermatitis from Parthenium hysterophorus

A Parthenium research group was formed two years ago and has attracted as correspondents about forty interested individuals representing dermatology, immunology, botany, weed science, phytochemistry, agriculture and more recently, government. The aim of the group is to circulate information by means of a Newsletter, six numbers of which have been sent so far. Material for distribution can be sent to Dr. Mitchell. The actual distribution will be carried out through Dr. E. Rodríguez (Developmental and Cell Biology, University of California, Irvine) to whom inquiries can be made for past numbers of the Newsletter. A European group has recently been formed for the study of Compositae dermatitis in Europe. Dr. Neil Hjork (Department of Dermatology, Konenhaven, Amts Sygehus Igentofte, 2900 Hellerup, Denmark) is responsible for the Newsletter, which is presently restricted to particular members. Presently the new findings are considered pre-publication and confidential. As this group developes, further information may become available. Communication between the three groups might well prove worthwhile.

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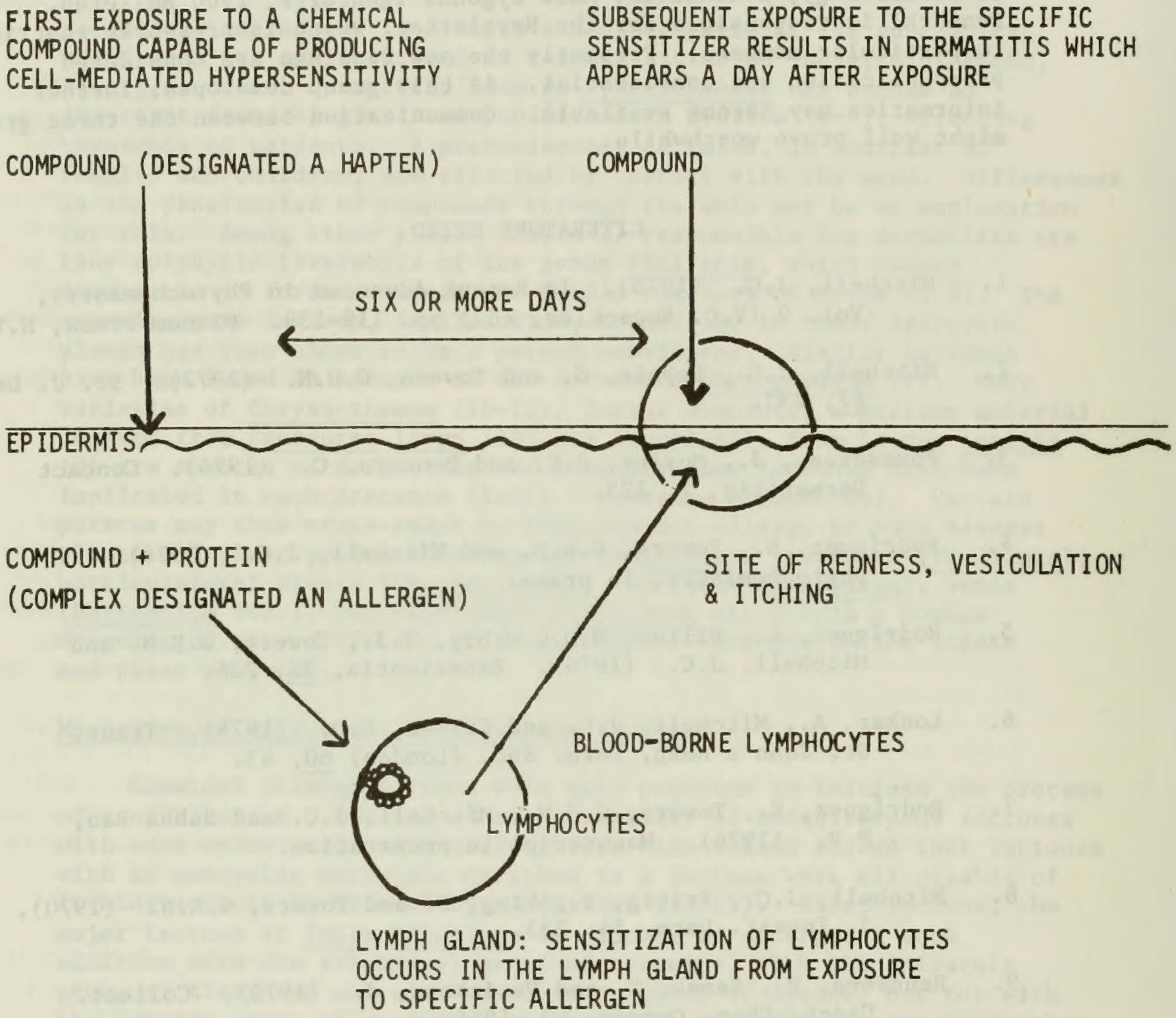
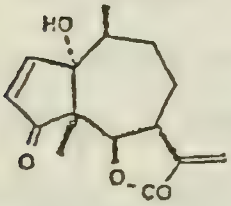
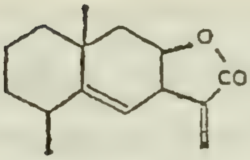
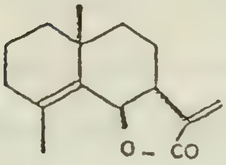
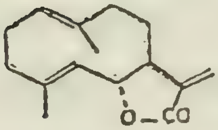
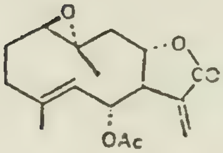
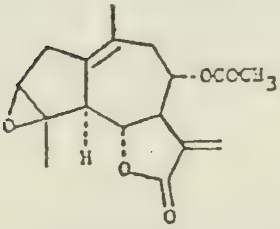

FIRST EXPOSURE TO A CHEMICAL COMPOUND CAPABLE OF PRODUCING CELL-MEDIATED HYPERSENSITIVITY
SUBSEQUENT EXPOSURE TO THE SPECIFIC SENSITIZER RESULTS IN DERMATITIS WHICH APPEARS A DAY AFTER EXPOSURE
COMPOUND (DESIGNATED A HAPTEN)
COMPOUND
SIX OR MORE DAYS
EPIDERMIS
COMPOUND + PROTEIN (COMPLEX DESIGNATED AN ALLERGEN)
SITE OF REDNESS, VESICULATION & ITCHING
BLOOD-BORNE LYMPHOCYTES
LYMPHOCYTES
LYMPH GLAND: SENSITIZATION OF LYMPHOCYTES OCCURS IN THE LYMPH GLAND FROM EXPOSURE TO SPECIFIC ALLERGEN

Figure 1. Pathogenetic mechanisms of allergic contact dermatitis (1).

Table 1. Plants of the family Compositae which have been reported to cause contact dermatitis (1).

Achillea millefolium, *Ambrosia* spp., *Anthemis nobilis*, *Arctotheca* (*Cryptostemma*) *calendulaceum*, *Arnica montana*, *Artemisia* spp., *Aster multiflorus*, *Buphthalmum salicifolium*, *Cassinea aculeata*, *Centaurea americana*, *Chrysanthemum* spp., *Cichorium endivia*, *C. intybus*, *Cosmos bipinnatus*, *Cynara scolymus*, *C. cardunculus*, *Dahlia* sp., *Erigeron* (*Leptilon*) *canadensis*, *Eupatorium serotinum*, *Gaillardia* sp., *Galinsoga parviflora*, *Haplopappus* (*Prionopsis*) *ciliata*, *Helianthus annuus*, *Helenium autumnale*, *H. microcephalum*, *H. tenuifolium*, *Helipterum charsleyae*, *Heterotheca* (*Chrysopsis*) *subaxillaris*, *Hieracium auricula*, *Humea elegans*, *Inula brittanica*, *I. graveolens*, *Iva angustifolia*, *I. microcephala*, *I. xanthifolia*, *Lactuca sativa*, *L. sativa* var. *longifolia*, *Matricaria chamomilla*, *Olearia* spp., *Oxytenia acerosa*, *Parthenium argentatum*, *P. hysterophorus*, *Pyrethrum* (*Chrysanthemum*) spp., *Rudbeckia hirta*, *Rutidosis helichrysoides*, *Saussurea lappa*, *Solidago serotina*, *S. virga aurea*, *Tagetes* spp., *Tanacetum vulgare*, *Taraxacum officinale*, *Telekia* (*Buphthalmum*) sp.,*Vernonia baldwinii*, *Xanthium californicum*, *X. canadense*, *X. chinese*, *X. spinosum*, *X. strumarium*.

Table 2. Some sesquiterpene lactones reported to cause allergic contact dermatitis in humans (4).

COMPOUND	Plant Source
 Parthenin	*Parthenium hysterophorus*
 Alantolactone	*Inula helenium* *I. racemosa*
 Frullanolide	*Frullania tamarisci*
 Costunolide	*Saussurea lappa* *Laurus nobilis*
 Pyrethrosin	*Chrysanthemum* spp.
 Arteglasin-A	*Chrysanthemum indicum*

ECOLOGICAL AMPLITUDES OF SOME ECONOMIC ASTERACEAE

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Elsewhere a preliminary tabulation of economic plants and their ecological distribution has been published (Duke, Hurst, and Terrell, 1975). A similar tabulation showing the ecological amplitudes of composites could be very useful. This note is intended to:

(1) tabulate ecological amplitudes of some economic species of Asteraceae

(2) suggest that an analysis of the asteraceous flora of a remote area can yield ecological parameters

(3) solicit additional "case histories" from interested readers. Interested readers are invited to submit copies of any local composite floras associated with ecological data or climatological summaries to the author.

In Table 1, a scientific name of the composite is followed by a common name. Authorities for scientific names will be found in Duke and Terrell (1974). In the "life zone" column, ranges in life zone are tabulated, using the symbols: T = Tropical; S = Subtropical; W = Warm Temperate; C = Cool Temperate; B = Boreal; x = Desert and Desert Shrub; t = Thorn; s = Steppe; v = Very Dry Forest; d = Dry Forest; w = Wet Forest; and r = Rain Forest Life Zone; as defined by Holdridge (1947). Following the pH column, the annual precipitation is tabulated. Annual temperature is tabulated by averaging the monthly means, values below 0°C treated as 0 and values above 30 treated as 30. This tabulation represents responses to questionnaires on file in the Plant Taxonomy Laboratory, with no resort to the published literature.

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Table 1. List of some economically important Asteraceae and their ecological amplitudes.

SCIENTIFIC NAME	COMMON NAME	LIFE ZONE	LIFE STYLE	pH	ANN. PRECIP. (DM)	ANN. TEMP. (°C)
ANTHEMIS NOBILIS	ROMAN CHAMOMILE	Bm Td	P, H	6.8-8.0	4-14	7-24
ARCTIUM LAPPA	GREAT BURDOCK	Bw Wtm	P/A,B/A,H	4.5-7.8	3-13	5-19
ARNICA MONTANA	ARNICA	Bw Wdm	P, H	5.8-7.6	5-13	5-19
ARTEMISIA ABROTANUM	SOUTHERNWOOD	Cmw Wm	P, S	6.3-7.6	4-13	7-19
ARTEMISIA ABSINTHIUM	WORMWOOD	Bw Sd	P, H	4.8-8.2	3-13	3-21
ARTEMISIA CINA	SANTONICA		P, S		10	24
ARTEMISIA DRACUNCULUS	TARRAGON	Bm Wtm	P, H	6.3-7.8	3-13	7-17
ARTEMISIA MARITIMA	SEA WORMWOOD	Csw Sd	P, H	6.0-7.6	5-8	7-21
ARTEMISIA VULGARIS	MUGWORT	Csw Tm	P, B, H	4.8-8.2	3-42	6-27
CALENDULA OFFICINALIS	POT MARIGOLD	Bm Tvw	A, H	4.5-8.3	3-25	6-25
CARTHAMUS TINCTORIUS	SAFFLOWER	Csm Txm	A, H	5.5-8.3	2-15	6-27
CHRYSANTHEMUM BALSAMITA	COSTMARY	Csw Wdw	P, H	5.0-7.6	5-27	9-18
CHRYSANTHEMUM CINERARIIFOLIUM	PYRETHRUM	Cmw Sdm	P, H	5.2-7.5	7-26	8-27
CHRYSANTHEMUM OCCCINEUM	PERSIAN INSECT FLOWER	Cmw Sm	P, H	5.2-7.0	6-26	7-23
CHRYSANTHEMUM CORONARIUM	GARLAND CHRYSANTHEMUM	Cmw Sdm	A, H	5.2-7.5	6-26	7-25
CICHORIUM ENDIVIA	ENDIVE	Cmw Tm	A, B, H	5.3-8.3	3-25	7-27
CICHORIUM INTYBUS	CHICORY	Bm Tvm	P, H	4.5-8.3	3-40	6-27
CYNARA CARDUNCULUS	CARDOON	Cmw Wtm	P, H	5.0-8.3	3-12	9-19
CYNARA SCOLYMUS	GLOBE ARTICHOKE	Cmw Sdm	P, H	5.0-8.3	3-26	9-20
GUIZOTIA ABYSSINICA	NIGER SEED	Wdm Tvm	A, H	5.3-6.5	7-18	13-26
HELIANTHUS ANNUUS	SUNFLOWER	Bmr Tvw	A, H	4.5-8.3	2-40	6-27
HELIANTHUS ANNUUS X TUBEROSUS	SUNCHOKE	Bm Tt	P, H	5.8-8.0	4-25	6-27
HELIANTHUS TUBEROSUS	JERUSALEM ARTICHOKE	Csw Tm	P/A, H	4.5-8.3	3-28	7-27
INULA HELENIUM	ELECAMPANE	Cmw Wdm	B, P, H	4.5-7.5	5-13	7-19
LACTUCA SATIVA	LETTUCE	Bmw Tdw	A, H	4.2-8.3	3-41	5-27
LACTUCA VIROSA	BITTER LETTUCE	Cw Sm	A, B, H	7.2-7.6	3-17	7-23
MATRICARIA CHAMOMILLA	WILD CHAMOMILE	Csw Sd	A, H	4.8-8.3	4-13	7-21
PARTHENIUM ARGENTATUM	GUAYULE	Bm Td	P, H, S	7.3-7.8	3-21	11-25
SPILANTHES ACMELLA	PARA CRESS	Sd Tm	A, H	5.5-5.7	8-40	19-25
STEVIA REBAUDIANA	KAA HE'E	Wm Td	P, S	6.3-8.0	12-16	16-25
TANACETUM VULGARE	TANSY	Cmw Wdm	P, H	4.8-7.5	4-13	7-17
TARAXACUM KOK-SAGHYZ	RUSSIAN DANDELION	Bw Sm	P, H	6.0-7.3	5-17	5-23
TARAXACUM OFFICINALE	DANDELION	Bmr Sdm	P, H	4.2-8.3	3-17	5-23
TRAGOPOGON PORRIFOLIUS	SALSIFY	Cmw Wtm	B/A, H	5.5-8.2	3-13	7-19
TUSSILAGO FARFARA	COLTSFOOT	Bw Wdm	P, H	4.5-7.5	5-13	5-15
VERNONIA ANTHELMINTICA	KINKAOIL IRONWEED	Sm Tw	A, P, H	6.8-7.3	11-42	13-27

TYPES OF ASTERACEAE AT THE PHILADELPHIA ACADEMY OF NATURAL SCIENCES (PH)

Part III. Segregated types and selected authentic material of the Vernonieae and Eupatorieae.*

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VERNONIEAE

Elephantopus carolinianus (*beta*) *simplex* Nutt., *E. carolinianus* f. *vestitus* Fernald; *Elephantosis quadriflora* Less.;

Piptocarpha angustifolia Dusen;

Stilpnopappus pittieri Gleason;

Vernonia acuminata DC.; *V. altissima* Nutt., *V. arachniolepis* Dusen, *V. aristosquamosa* Britt., *V. bakerana* Britt.; *V. baldwini* Torrey, *V. bangii* Rusby, *V. blodgettii* Small, *V. boliviana* Britt., *V. caput-medusae* Nutt., *V. corymbosa* Schweinitz in Keating, *V. costata* Rusby, *V. ervendbergii* Gray, *V. extensa* DC., *V. glauca* f. *longiaristata* Fernald, *V. greggii* var. *palmeri* Gray, *V. guadeloupensis* Heller, *V. hieracioides* Gris., *V. inequiserrata* Gris., *V. interior* Small, *V. jubifera* Rusby, *V. liatroides* DC., *V. lindheimeri* Engelm. & Gray, *V. lobelioides* Wallich, *V. novenboracensis* var. (*beta*) T. & G., *V. patuliflora* Rusby, *V. paucifolia* Rusby, *V. paucisquamata* Rusby, *V. robusta* Rusby, *V. scaberrima* Nutt., *V. senecionaefolia* Britt., *V. sphaeroidea* Nutt., *V. trichotoma* Gleason, V. *trilectorum* Gleason, *V. trixioides* Rusby, *V. vagans* Wallich.

EUPATORIEAE

Addisonia virgata Rusby; *Adenostemma pumila* Nutt.; *Ageratella microphylla* Gray; *Ageratum lucidum* Rob., *A. muticum* Gris.;

Brickellia amblyolepis Rob., *B. baccharidea* Gray, *B. betonicaefolia* Gray, *B. betonicaefolia* var. *conduplicata* Rob., *B. betonicaefolia* var. *elliptica* Rob., *B. brachiata* Gray, *B. cardiophylla* Rob., *B. cordifolia* Elliott, *B. coulteri* Gray, *B. cuspidata* Gray, *B. cylindracea* Gray ex Engelm., *B. fendleri* Gray, *B. glutinosa* Gray ex Watson, *B. grandiflora* Nutt., *B. greenei* Gray, *B. hymenochlaena* Gray, *B. laciniata* Gray, *B. lancifolia* Rob. & Greenm., *B. leptophylla* Scheele, *B. monocephala* Rob., *B. nevinii* Gray, *B. nutans* Rob. & Greenm., *B. oblongifolia* Nutt., *B. oliganthes* Gray, *B. pacayensis* Coulter, *B. palmeri* Gray, *B. parryi* Gray, *B. parvula* Gray, *B. pringlei* Gray, *B. pulcherrima* Rob., *B. rusbyi* Gray, *B. saltillensis* Rob., *B. simplex* Gray, *B. solidaginifolia* Gray, *B. squamulosa* Gray, *B. thyrsiflora* Gray, *B. vincentiana* Greene, *B. wislizeni* Gray, *B. wrightii* Gray; *Bulbostylis deltoides* Buckley (sic! *Bulbostyle* DC., *Bolbostyle* DC.=*Brickellia*, non Cyperaceae);

Carphochaete bigelovii Gray; *Clavigera riddellii* Gray;

Eupatorium acutidentatum Rob., *E. ageratifolium* var. *purpureum* Coulter, *E. amblyolepis* Rob., *E. amplifolium* Gray, *E. argentinum* Lorentz, *E.*

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*For Parts I and II of this article, see issues Number Two and Three of the NEWSLETTER.

baccharoides var. araneotectum Rob., E. betonicum Hemsl., E. campanulatum Rusby, E. capitatum Rusby, E. ceanothifolium Muhlenberg ex Willdenow, E. chapalense Rob., E. chrysostyloides Rob., E. collinum DC., E. collodes Rob. & Greenm., E. crassiramum Rob., E. dasycarpum Gray, E. deltoides Braun, E. dispar Rob., E. eleutheranthemum Rusby, E. eriocarpum Rob. & Greenm., E. erythropapum Rob., E. espinosarum Gray, E. guaianensis Britt., E. gynoxoides Rusby, E. heterolepis Gris., E. hymenolepis Rob., E. hypoleucum Gris., E. hyssopinum Gray, E. killipii Rob., E. lanceolatum Muhlenburg ex Willdenow, E. lantanifolium Gris., E. latipaniculatum Rusby, E. leptodictyon Gray, E. lozanoanum Rob., E. malvaefolium DC., E. mesoreopolum Rob., E. mexiae Rob., E. oreithales Greenm., E. oresbium Rob., E. ornatiloba Rob., E. palmeri Gray, E. photinum Rob., E. plucheoides Gris., E. polycladum Dusen, E. pringlei Rob. & Greenm., E. pubescens Muhlenberg ex Willdenow, E. pulchellum var. angustifolium Watson, E. pycnocephalum var. caucanum Rob., E. quadrangulare DC., E. recurvans Small, E. rhodochlamydeum Gray, E. rotundifolium var. cordigerum Fernald, E. rugosum var. chlorolepis Fernald, E. rupestre Raf., E. rupicoloa Rob. & Greenm., E. sabeanum Buckley, E. saltillense Rob., E. saltuense Fernald, E. scabriusculum Schweinitz, E. scordonoides Gray, E. scordonoides var. grossedentatum Rob., E. serotinum Michaux, E. serotinum var. polyneuron Fernald, E. sessilifolium var. brittonianum Porter, E. sonorae Gray, E. sphenopodum Rusby, E. spinacaefolium DC., E. stipuliferum Rusby, E. strictum Gray, E. tashiroi Hayata, E. thymifolium Britt., E. torreyanum Short & Peter, E. triosteifolium Rusby, E. tuerckheimii Benth., E. turbinatum Gray, E. verticillatum Willdenow, E. wrightii Gray;

Hofmeisteria pluriseta Bray;

Kuhnia chlorolepis Wooton & Stanley, K. glutinosa Elliott, K. macrantha Buckley, K. rosmarinifolia gracillima Gray, K. tenuifolia Schweinitz;

Laciniaria biacuta Steele, L. bushii Steele, L. chapmanii var. longifolia Nash, L. codonophora Steele, L. deamiae Lunell, L. garettensis Steele, L. ipswichiana Steele, L. laevigata Nutt., L. oakesii Steele, L. scariosa var. propinqua Lunell, L. scariosa var. porrecta Lunell, L. tracyi Alex. ex Small, L. turgida Steele; Lavenia carnosa Wallich; Liatris brachystachya Nutt., L. chapmanii T. & G., L. corymbosa Nutt., L. garberi Gray, L. gracilis Pursh, L. graminifolia Pursh, L. halei Small (?), L. helleri Porter, L. lanceolata Engelm., L. lanceolata Baldwin, L. oppositifolia Nutt., L. pauciflosculosa Nutt., L. punctata Hooker (?), L. ramosa Schweinitz, L. resinosa Nutt., L. squamosa Nutt., L. stricta McNab, L. tenuifolia Nutt., L. virgata Nutt.;

Margacola parvula Buckley;

Mikania antioquiensis var. subcuneata Rob., M. caldasana Rob., M. caustolepis Rob., M. clematidiflora Rob., M. cochabambana Rob., M. comarapensis Rob., M. ferruginea Rusby, M. flabellata Rusby ex Rob., M. granulata Rob., M. granulata var. integra Rob., M. killipii Rob., M. leucophylla Rob., M. micayensis Rusby, M. mucronulifera Rob., M. nigropunctulata var. phaenodonta Rob., M. phaenodonta Rob., M. pubescens Muhlenburg, M. pubescens Nutt., M. smaragdina Dusen, M. swartziana Gris., M. ypacarayensis Holmes &

McDaniel;

Ophryosporus angustifolius Rob.;

Piptothrix aegiroides Rob., *P. jaliscensis* Greenm., *P. palmeri* Gray, *P. pubens* Gray; *Piqueria laxiflora* Rob. & Sea., *P. pringlei* Rob. & Sea., *P. pyramidalis* Rob., *P. serrata* Gray, *P. serrata* var. *augustifolia* Rob. & Greenm.;

Stevia alatipes Rob., *S. amabilis* Lemmon, *S. berlandieri* Gray, *S. callosa* Nutt., *S. clinopodioides* Greenm., *S. collodes* Greenm., *S. diffusa* Greenm., *S. elatior* var. *decumbens* Rob. & Greenm., *S. foliosissima* Greene, *S. lozanoi* Rob., *S. madrensis* Gray, *S. monardaefolia* var. *macrophylla* Rob., *S. obovata* var. *aristifera* Rob., *S. palmeri* Gray, *S. plummerae* var. *durangensis* Rob., *S. pringlei* Watson, *S. serrata* var. *ovalis* Rob., *S. simulans* Rob., *S. sphacelata* Nutt. ex Torrey, *S. stenophylla* Gray, *S. tephra* Rob., *S. venosa* Gray;

Trichocoronis wrightii Gray;

Willoughbya brevipedunculata Rusby, *W. heterophylla* Small, *W. longiacuminata* Rusby, *W. pallida* Rusby, *W. trifolia* Rusby.

NEWS FROM INDIVIDUALS AND INSTITUTIONS

Fifty-eight readers responded to the call for information in the last number of the NEWSLETTER. The return was encouraging, and the data should be of great interest to workers in Compositae. Because of the large amount of data to be presented, however, the information is not included here but will appear instead in the next number of the NEWSLETTER. Readers still wishing to be included should send a list of research activities, travel plans, requests for material, etc., to the Editor.

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Please respond!! Please respond!!

DO WE NEED A GLOSSARY?

Should usage of morphological/technical terms that are peculiar to synantherology (or compositology) be standardized? For example, where does "tube" end and "throat" begin in corollas of perfect disc (or is it disk?) florets? Should use of "palea" be restricted to receptacular bracts? Should receptacular bristles and setae be excluded from the meaning of "paleae"? Should "squamella" refer to members of a pappus? And so on.

H. Robinson and J. Strother have agreed to coordinate development of a glossary of terms used in Compositae systematics provided that the readers of the Compositae Newsletter show support for such a project.

Is such a glossary needed?________________________________

What terms should it include?______________________________

Which of these structures should be illustrated?________________

Should new terms be coined for unnamed structures?______________

Should non-English equivalents be included?____________________

What languages?____

Where and/or how should such a glossary be published?__________

Answers to these questions and/or general comments on the proposed project should be sent to:

Dr. H. Robinson
Department of Botany
Smithsonian Institution
Washington D.C. 20560, U.S.A.

or

Dr. J. Strother
Botany - Herbarium
University of California
Berkeley CA 94720, U.S.A.

Please respond!! Please respond!!